CLAIMS:

I claim:

1. A composition suitable for use in the manufacture of construction board comprising:

an expanded mineral present at up to about 40% by weight;

calcium sulfate present at up to about 60% by weight; and

a synthetic binder, said synthetic binder being selected from the group consisting essentially of:

(i) a vinyl acetate emulsion comprising a homogenous blend of suspended polyvinyl acetate particles in polyvinyl alcohol and water, and a solution comprising a 10% to 25% solution of polyvinyl alcohol to water, said solution being present in said composition in an amount of approximately 0.1% to about 25% of said vinyl acetate emulsion;

(ii) a water-based non-V.O.C. acrylic emulsion comprising acrylic particles suspended in solution; and

(iii) a water-based non-V.O.C. polyurethane emulsion comprising polyurethane particles suspended in solution.

2. The composition of claim 1, further comprising:

sodium trimetaphosphate present at about 0.01% to about 10% by weight.

3. The composition of claim 1, said binder further comprising:

a solution comprising a 5% to 30% solution of nonionic ethoxilated alcohol surfactant to water, said solution being present in said composition in an amount of approximately 0.1% to 25% of said binder.

4. A composition suitable for use in the manufacture of construction board comprising:

an expanded mineral present at up to about 40.0% by weight;

calcium sulfate present at up to about 60% by weight; and

a water-based non-V.O.C. acrylic emulsion comprising acrylic particles suspended in solution.

5. A composition suitable for use in the manufacture of construction board comprising:

an expanded mineral present at up to about 40.0% by weight;

calcium sulfate present at up to about 60% by weight; and

a water-based non-V.O.C. polyurethane emulsion comprising polyurethane particles suspended in solution.

6. A composition suitable for use in the manufacture of construction board comprising:

a dry powder mineral substrate selected from the group of minerals comprising calcium sulfate, perlite, and combinations thereof; and

a synthetic binder, said synthetic binder comprising starch, a boron source, and an emulsion selected from the group consisting essentially of:

(i) a vinyl acetate emulsion comprising a homogenous blend of suspended polyvinyl acetate particles in polyvinyl alcohol and water, and a solution comprising a 10% to 25% solution of polyvinyl alcohol to water, said solution being present in said composition in an amount of approximately 0.1% to about 25% of said vinyl acetate emulsion;

(ii) a water-based non-V.O.C. acrylic emulsion comprising acrylic particles suspended in solution; and

(iii) a water-based non-V.O.C. polyurethane emulsion comprising polyurethane particles suspended in solution.

7. The composition of claim 6, further comprising:

sodium trimetaphosphate present at about 0.01% to about 10% by weight.

8. The composition of claim 6, said binder further comprising:

a solution comprising a 5% to 30% solution of nonionic ethoxilated alcohol surfactant to water, said solution being present in said composition in an amount of approximately 0.1% to 25% of said binder.

9. The composition of claim 6, said starch being present at about 0.30% to about 0.75% by weight.

10. The composition of claim 6, said boron source being present at up to about 0.35% by weight.

11. The composition of claim 6, wherein said starch is selected from the group comprising corn starch, dent corn starch, oxidized starch, waxy oxidized starch, dextrin, and white-canary dextrin.

12. The composition of claim 6, wherein said boron source is selected from the group comprising borate and boric acid.

13. The composition of claim 6, wherein said boron source is selected from the group comprising sodium tetraborate pentahydrate and sodium tetraborate decahydrate.

14. A construction board composition comprising:

a mineral selected from the group consisting essentially of calcium sulfate, perlite, and combinations thereof;

a synthetic binder, said synthetic binder comprising starch, a boron source, and a polymer emulsion; and

paper cover sheets sandwiching said mineral and said binder formulation therebetween.

15. The construction board composition of claim 14, wherein said paper cover sheets are formed from a virgin paper pulp comprising fibers having a length of at least one inch.

16. The construction board composition of claim 14, wherein said paper cover sheets are formed from a paper pulp comprising non-wood pulp fibers.

17. The construction board composition of claim 16, wherein said paper pulp forming said paper cover sheets further comprises recycled waste paper wood pulp fibers.

18. The construction board composition of claim 14, wherein said paper cover sheets comprise a multi-layer structure, said paper cover sheets further comprising a fiberglass mesh integrated between an inner face liner of said paper cover sheet and remaining layers of said multi-layer structure.

19. The construction board composition of claim 14, said paper cover sheets further comprising a fire retardant agent.

20. The construction board composition of claim 19, wherein said fire retardant agent comprises an agent selected from the group consisting essentially of boric acid, zinc borate, sulfamates, diammonium phosphate, nitrogen compounds, antimony oxide, silica, titanium oxide, and zircon.

21. The construction board composition of claim 20, wherein said fire retardant agent is present at about 0.15% to about 3% by weight of the finished construction board.

22. A method of manufacturing a construction grade construction board product comprising the steps of:

(a) forming a first mixture by adding a first emulsion to a stream of metered water, said first emulsion being selected from the group consisting essentially of:

(i) a first solution comprising a 10% to 25% solution of polyvinyl alcohol to water added to a vinyl acetate emulsion comprising a homogeneous blend of suspended polyvinyl

acetate particles in polyvinyl alcohol and water, such that said first solution is present in said first emulsion in an amount of approximately 0.1% to about 25% of said vinyl acetate emulsion;

(ii) a water-based non-V.O.C. acrylic emulsion comprising acrylic particles suspended in solution; and

(iii) a water-based non-V.O.C. polyurethane emulsion comprising polyurethane particles suspended in solution;

(b) forming a second mixture by adding a mineral selected from the group consisting essentially of calcium sulfate, perlite, and combinations thereof, to said first mixture;

(c) combining said second mixture with an additional amount of water;

(d) gradually preparing a slurry by mixing and stirring said second mixture and said water to form said slurry;

(e) enveloping said slurry between two paper cover sheets to form a wet board; and

(f) drying said wet board at a temperature in the range of 75°C to 325°C.

23. The method of claim 22, further comprising the step of pre-coating an inside face of said paper cover sheets with said first emulsion prior to enveloping said slurry between said paper cover sheets.

24. The method of claim 22, further comprising the step of vigorously mixing said first mixture to foam said first mixture prior to forming said second mixture.

25. The method of claim 22, further comprising the step of adding an accelerating agent after preparing said slurry and prior to enveloping said slurry between two paper cover sheets.

26. The method of claim 25, wherein said accelerating agent comprises an alkali element present at about 0.001% to about 3% by weight.

27. The method of claim 22, further comprising the step of:

applying heat to said wet board during its transfer from a board forming apparatus to a drying kiln.

28. The method of claim 22, further comprising the step of:

adding starch and borate to said first mixture prior to forming said second mixture.

29. The method of claim 28, in which said starch is selected from the group comprising corn starch, dent corn starch, oxidized starch, waxy oxidized starch, dextrin, white-canary dextrin, and combinations thereof.

30. The method of claim 28, in which said starch is present in the amount of about 0.001% to about 15% by weight.

31. The method of claim 30, in which said starch is present in the amount of about 0.30% to about 0.75% by weight.

32. The method of claim 28, in which said borate is selected from the group comprising sodium tetraborate pentahydrate and sodium tetraborate decahydrate.

33. The method of claim 28, in which said borate is present in the amount of about 0.001% to about 10% by weight.

34. The method of claim 33, in which said borate is present in the amount up to about 0.35% by weight.

35. The method of claim 22, further comprising the step of adding a solution comprising a 5% to 30% solution of nonionic ethoxilated alcohol surfactant to water to said first solution prior to forming said second mixture.

36. The method of claim 35, wherein said solution comprising a 5% to 30% solution of nonionic ethoxilated alcohol surfactant to water is added to said first solution in an amount of approximately 0.1% to 25% of said first emulsion.

37. In a wallboard manufacturing facility, apparatus for forming a wallboard comprising an expanded mineral and a binder formulation having at least one self-crosslinking permanently tacky polymer, said apparatus comprising:

an expander system for expanding a mineral;

a plurality of expanded mineral storage silos;

a first transport means for directing an expanded mineral from said expander system to said plurality of storage silos;

a secondary expanded mineral feed tank;

a second transport means for directing said expanded mineral from said storage silos to said secondary expanded mineral feed tank;

blender means receiving said expanded mineral from said secondary expanded mineral feed tank and combining said expanded mineral with remaining dry materials in said wallboard;

mixing means for mixing said expanded mineral, said dry materials, liquid components of said wallboard, water, and foaming agents into a slurry;

wallboard forming means for sandwiching said slurry between a plurality of paper sheets to form a wet board;

conveyor means for conveying said wet board from said wallboard forming means to a wet board cutting means;

drying means for drying said wet board; and

transfer means for transferring said wet board from said cutting means to said drying means.

38. The apparatus of claim 37, further comprising a plurality of expander systems.

39. The apparatus of claim 38, wherein said expander systems comprise perlite expanders.

40. The apparatus of claims 37, wherein each of said first and second transport means comprise dense phase pneumatic transport systems.

41. The apparatus of claim 37, further comprising programmable control means, said control means constantly maintaining at least one of said storage silos in a filled condition, said control means further identifying a storage silo containing therein a maximum amount of expanded mineral in comparison to each of the other of said storage silos, said control means further directing said expanded mineral from said storage silo containing therein said maximum amount of expanded mineral to said secondary expanded mineral feed tank such that said feed tank is constantly maintained in a filled condition.

42. The apparatus of claim 37, wherein said secondary expanded mineral feed tank is positioned within said wallboard manufacturing facility and adjacent to said production equipment.

43. The apparatus of claim 37, further comprising a heat treatment means positioned over said conveyor means for directing heat towards said wet board.

44. The apparatus of claim 43, wherein said heat treatment means further comprises:

a tunnel at least partially encapsulating said conveyor means; and

a plurality of air ducts located in an upper interior surface of said tunnel, said air ducts configured to direct hot air onto said wet board.

45. The apparatus of claim 44, wherein said drying means comprises a drying kiln having a hot air recycling system, and said air ducts are in fluid communication with said hot air recycling system to direct recycled heat from said drying kiln to said heat treatment means.

46. The apparatus of claim 43, wherein said heat treatment means further comprises:

a plurality of drying hoods positioned overtop of said conveyor means; and

a plurality of air ducts in fluid communication with said drying hoods for directing hot air into said drying hoods and towards said wet board.

47. The apparatus of claim 46, wherein said drying means comprises a drying kiln having a hot air recycling system, and said air ducts are in fluid communication with said hot air recycling system to direct recycled heat from said drying kiln to said heat treatment means.

48. The apparatus of claim 46, further comprising an elastomeric, flat hose having a first open end and a second end opposite said first end and attached to a dispensing outlet on said mixing means for dispensing said slurry from said mixing means.